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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/053,446	01/17/2002	Janis Virbulis	WSAG 0128 PUS	3544
22045	7590	02/02/2006	EXAMINER	
BROOKS KUSHMAN P.C. 1000 TOWN CENTER TWENTY-SECOND FLOOR SOUTHFIELD, MI 48075			SONG, MATTHEW J	
			ART UNIT	PAPER NUMBER
			1722	

DATE MAILED: 02/02/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/053,446

Applicant(s)

VIRBULIS ET AL.

Examiner

Matthew J. Song

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 October 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2,14,17 and 18 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,14,17 and 18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____.

DETAILED ACTION

1. In view of the appeal brief filed on 10/11/2005, PROSECUTION IS HEREBY REOPENED.

A new grounds of rejection is set forth below.

To avoid abandonment of the application, appellant must exercise one of the following two options:

(1) file a reply under 37 CFR 1.111 (if this Office action is non-final) or a reply under 37 CFR 1.113 (if this Office action is final); or,

(2) initiate a new appeal by filing a notice of appeal under 37 CFR 41.31 followed by an appeal brief under 37 CFR 41.37. The previously paid notice of appeal fee and appeal brief fee can be applied to the new appeal. If, however, the appeal fees set forth in 37 CFR 41.20 have been increased since they were previously paid, then appellant must pay the difference between the increased fees and the amount previously paid.

A Supervisory Patent Examiner (SPE) has approved of reopening prosecution by signing below:

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various

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claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 1, 2 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Iida et al (US 6,077,343) in view of Haida (DE 3701733 A1), an English Translation has been provided.

In a method of forming a silicon single crystal, note entire reference, Iida et al teaches an apparatus for pulling a silicon single crystal according to the Czochralski method comprising a crucible 32, an annular solid-liquid interface insulator 8, an upper surrounding insulator 9, and a radiant heat reflecting plate attached to the lower portion (col 10, ln 30-65; col 11, ln 20-45; and Fig 3), this insulator and reflecting plate reads on applicant's heat shield above the crucible. Iida et al also teaches applying a magnetic field to the silicon melt in a vertical direction or in a like direction to suppress a convection of the melt to thereby stably grow a single crystal (col 10, ln 60 to col 11, ln 5). Iida et al also teaches growing crystals having a diameter of 8 to 16 inches (~200-400 mm) would possible (col 14, ln 35-40) and using a crucible with a diameter of 18 inches (~457.2 mm) (col 13, ln 1-10).

Iida et al teaches using a vertically oriented magnetic field, however Iida et al does not teach using a traveling magnetic field.

In a method of growing single crystal silicon in a Czochralski process, note entire translation, Haida et al teaches a thermal convection flow occurs in a growing monocrystal is not

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rotated, and the application of a traveling magnetic field serves or a further suppression of the undesirable thermal convection flow, without reducing the forced convection flow (pg 10-11 of the translation). Haida et al teaches an upward traveling magnetic field of 100 Gauss is applied (pg13), this reads on applicant's intensity which is sufficient to attenuate low-frequency temperature fluctuations in the melt because 100 Gauss (10 mT) is within the range of 2-15 mT taught by applicant teach using 2-15, note page 10 of the instant specification.

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Iida et al by using an upwardly traveling magnetic field to suppress undesirable thermal convection, as taught by Haida.

Referring to claim 2, Iida et al teaches $13-16 \text{ ppm}$, which is greater than 5×10^{17} atoms/cm³, note Wilson et al (US 6,284,384) below.

4. Claims 1, 2 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Iida et al (US 6,077,343) in view of Haida (DE 3701811 A1), an English Translation has been provided.

Iida et al teaches all of the features of claim 1, as discussed previously, except Iida et al does not teach using a traveling magnetic field.

In a method of growing single crystal silicon in a Czochralski process, note entire translation, Haida et al teaches using a downward moving traveling magnetic field is applied to prevent the rising thermal convection flow in the melt from reaching the walls of the pot (pg 8-9). Haida et al also teaches an intensity of 20-200 Gauss (2-20 mT), this reads on applicant's intensity which is sufficient to attenuate low-frequency temperature fluctuations in the melt because 20-200 Gauss

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(2-20 mT) is within the range of 2-15 mT taught by applicant teach using 2-15, note page 10 of the instant specification.

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Iida et al by using an downwardly traveling magnetic field o prevent the rising thermal convection flow in the melt from reaching the walls of the pot, as taught by Haida.

5. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Iida et al (US 6,077,343) in view of Haida (DE 3701733 A1), an English Translation has been provided, or in view of Haida (DE 3701811 A1), an English Translation has been provided, as applied to claim 1 above, and further in view of Lari et al.(US 4,905,756) or Morishita et al (JP 61-029128), an English Abstract has been provided.

The combination of Iida et al and Haida ('811) or the combination of Iida et al and Haida ('733) teaches all of the limitations of claim 14, except the traveling magnetic is due to three coils which are connected to a 3-phase power supply and the traveling magnetic field exerts a substantially vertically oriented force on the melt is generated by suitable selection of an order of connections; and the connections of the coils have a phase angle in an order of 0°-60°-120° or 0°-120°-240°. The combination of Iida et al and Haida ('811) or the combination of Iida et al and Haida ('733) teaches providing a traveling magnetic field but not the claimed means of producing the magnetic field.

In an apparatus for producing magnetic fields, note entire reference, Lari et al teaches a magnetic field traveling wave is produced with only two coil layers with current 180° out of phase and in the preferred embodiment, three coil layers 120° out of phase are used, this reads on

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applicant connections of the coils have a phase angle in an order of 0° - 120° - 240° . Lari et al also teaches an AC source supplies three-phase alternating current. Also, additional coil waves could be used to produce a traveling wave, for example four coils 90° out of phase. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Iida et al and Haida ('811) or the combination of Iida et al and Haida ('733) with Lari et al's means of producing a traveling magnetic field because selection of a known material based on its suitability for its intended use is held to be obvious (MPEP 2144.07).

In an apparatus for providing a magnetic field, Morishita et al teaches a magnetic generator made of a coil 30, which is formed of coils 31a, 31b 31c. And when a 3-phase AC current having 120° different positions are respectively flowed to the coils, a traveling magnetic field which moves in a prescribed direction is generated (Abstract), this reads on applicant connection of the coils have a phase angle in an order of 0° - 120° - 240° . It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Iida et al and Haida ('811) or the combination of Iida et al and Haida ('733) with Morishita et al's means of producing a traveling magnetic field because selection of a known material based on its suitability for its intended use is held to be obvious (MPEP 2144.07).

Response to Arguments

6. Applicant's arguments with respect to claims 1-2, 14 and 17-18 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

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7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Wilson et al (US 6,284,384) teaches a wafer prepared in a Czochralski process with an oxygen concentration 5×10^{17} to about 9×10^{17} atoms/cm³ is equivalent to 10-18 ppm (col 8, ln 60-67).

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J. Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Duane Smith can be reached on 571-272-1166. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew J Song
Examiner
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MJS
January 21, 2006

DUANE SMITH
PRIMARY EXAMINER

D-S
1-23-06